

**A NEW SUBGENUS OF *WYEOMYIA* (DIPTERA: CULICIDAE), WITH THE  
RECLASSIFICATION AND REDESCRIPTION OF *WYEOMYIA*  
(*DAVISMYIA*) *ARBOREA*, *WYEOMYIA* (*DENDROMYIA*) *TARSATA* AND  
*SABETHES* (*SABETHES*) *CARRILLOI*<sup>1</sup>**

RALPH E. HARBACH AND E.L. PEYTON<sup>2</sup>

*Walter Reed Biosystematics Unit, Department of Entomology, Walter Reed Army Institute of  
Research, Washington, DC 20307-5100*

**ABSTRACT.** A new subgenus, *Exallomyia*, of the genus *Wyeomyia* is established for three species previously included in the subgenera *Davismyia* and *Dendromyia*, and in the genus and nominate subgenus *Sabethes*. The terminalia of the holotype males of the three species, the midlegs of the males of two species, and the larvae and pupae of two species are illustrated.

## INTRODUCTION

During studies of the genera *Sabethes* Robinseau-Desvoidy and *Wyeomyia* Theobald, we discovered that *Sabethes carrilloi* Sutil O. and Pulido F. was misplaced at the generic level and actually represents a species of *Wyeomyia*. In a previous paper (Harbach and Peyton 1991), we mentioned that *carrilloi*, *Wy. arborea* Galindo, Carpenter and Trapido, and *Wy. tarsata* Lane and Cerqueira appear to represent a distinct phyletic line. The existence of this natural group became evident to us during a study of the immature stages and the male genitalia (the immature stages of *tarsata* are unknown). We consider that this uniform, easily distinguishable group of mosquitoes deserves subgeneric status as much as or more than some well-established subgenera of *Wyeomyia*. Accordingly, we propose the subgenus *Exallomyia* for these distinctive species.

This is the fourth paper in a series involving the generic and subgeneric placement and realignment of species within *Wyeomyia* and *Sabethes*. Previous papers dealt with the transfer of a species from *Sabethes* to a new subgenus in *Wyeomyia* (Harbach and Peyton 1990), transfer

of a subgenus and its type species from *Wyeomyia* to *Sabethes* (Harbach and Peyton 1991), and the recognition of a new subgenus within *Sabethes* (Harbach 1991). The descriptive terminology and abbreviations used in this paper are the same as that used in the previous papers.

## TAXONOMIC TREATMENT

### Genus *Wyeomyia* Theobald

#### Subgenus *Exallomyia*, new subgenus

**Type species.** *Wyeomyia tarsata* Lane and Cerqueira, 1942, Brazil. Included species: *Wyeomyia arborea* Galindo, Carpenter and Trapido, 1951, Panama; *Sabethes carrilloi* Sutil O. and Pulido F., 1978, Venezuela.

*Wyeomyia* (*Dendromyia*), Cleobonnea Series in part of Lane and Cerqueira 1942:531-532, 536, 588-589; Lane 1953:867, 945, 988-994.

*Wyeomyia* (*Dendromyia*) in part of Stone et al. 1959:83-88; Knight and Stone 1977:327-332.

*Sabethes* (*Sabethes*) in part of Ward 1984:249-250.

**Females.** Medium-sized mosquitoes. Moderately ornamented, dark scaling with subdued reflections to moderate iridescence. **Head:** Eyes adjoined above antennae and ventrally. Vertex, occiput and postgena covered with broad decumbent scales, scales mainly dark, pale on interocular space, along margin of eye and on

<sup>1</sup>The views of the authors do not purport to reflect the views of the Department of the Army or the Department of Defense.

<sup>2</sup>Reprint requests: Walter Reed Biosystematics Unit, Museum Support Center, Smithsonian Institution, Washington, DC 20560.

Report Documentation Page			Form Approved OMB No. 0704-0188		
Public reporting burden for the collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington VA 22202-4302. Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to a penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number.					
1. REPORT DATE <b>NOV 1991</b>		2. REPORT TYPE		3. DATES COVERED <b>00-00-1991 to 00-00-1991</b>	
4. TITLE AND SUBTITLE <b>A New Subgenus of Wyeomyia (Diptera: Culicidae), with the Reclassification and Redescription of Wyeomyia (Davismyia) Arborea, Wyeomyia (Dendromyia) Tarsata and Sabethes (Sabethes) Carrilloi</b>			5a. CONTRACT NUMBER		
			5b. GRANT NUMBER		
			5c. PROGRAM ELEMENT NUMBER		
6. AUTHOR(S)			5d. PROJECT NUMBER		
			5e. TASK NUMBER		
			5f. WORK UNIT NUMBER		
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) <b>Walter Reed Army Institute of Research, Department of Entomology, Walter Reed Biosystematics Unit, Washington, DC, 200307-510</b>			8. PERFORMING ORGANIZATION REPORT NUMBER		
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)			10. SPONSOR/MONITOR'S ACRONYM(S)		
			11. SPONSOR/MONITOR'S REPORT NUMBER(S)		
12. DISTRIBUTION/AVAILABILITY STATEMENT <b>Approved for public release; distribution unlimited</b>					
13. SUPPLEMENTARY NOTES					
14. ABSTRACT <b>see report</b>					
15. SUBJECT TERMS					
16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT <b>Same as Report (SAR)</b>	18. NUMBER OF PAGES <b>18</b>	19a. NAME OF RESPONSIBLE PERSON
a. REPORT <b>unclassified</b>	b. ABSTRACT <b>unclassified</b>	c. THIS PAGE <b>unclassified</b>			

postgena; ocular setae small, dark; 2 prominent, golden interocular setae and 2 similar, slightly weaker, closely approximated setae ventral to them. Clypeus and frons without setae and scales. Antenna plumose; pedicel with a few weak setae on inner surface, without scales; flagellomere 1 with patch of dark scales dorsally. Proboscis longer than antenna, slightly shorter to slightly longer than forefemur; dark-scaled. Maxillary palpus short, about 0.15 length of proboscis. *Thorax*: Scutum with recumbent spatulate scales, scales relatively small mesally, progressively larger laterally and posteriorly, very broad on supraalar and prescutellar areas and also on scutellum; middle of lateral margin with pale scales covering paratergite; median anterior promontory, supraalar and prescutellar setae present. Mesopostnotum with setae, without scales. Anteprepectum well developed and closely approximated; dark-scaled dorsally, pale-scaled ventrally, with small spot of pale scales dorsally adjacent to anterior promontory. Postprepectum and pleura with white or silvery-white spatulate scales, scales absent from lower proepisternum, narrow anterior area of mesokatepisternum, posterior margin of mesepimeron, mesomeron, metapleuron and metameron; upper proepisternal, prespiracular, prealar, lower mesokatepisternal and upper mesepimeral setae present; lower mesokatepisternal setae adjacent to middle of midcoxa. *Wing*: Dark-scaled; upper calypter with 1 (usually) or 2 prominent setae projecting from margin; alula with fringe of short setae; all veins with broad scales, including those on anterior margin of vein M. *Halter*: Dark-scaled. *Legs*: Coxae and trochanters largely covered with pale spatulate scales like those of pleura, post- and anteprocoxal scales present; femora, tibiae and tarsi mainly dark-scaled with bluish reflections; femora pale-scaled beneath; tibia all dark or pale beneath; tarsi entirely dark-scaled except hindtarsomere 1 with pale scales ventrally, usually for most of length but becoming less apparent distally. Fore- and midfemora about same length, longer than hindfemur; hindtibia distinctly shorter than hindfemur, hindtarsomere 1 longer than hindfemur. *Abdomen*: Terga mainly dark-scaled with bluish reflections, rather broadly white-scaled laterally, line of demarcation between dark and pale scaling more or less straight,

occasionally tending to extend slightly dorsad basally on one or more terga, particularly II, VI; sterna II-VIII white-scaled with long, prominent, semierect, caudally directed scales on midline.

**Males.** Similar to females except as follows.

*Head*: Proboscis with variable amount of pale scaling on ventral surface. *Legs*: At least midtarsus with some ventral pale scaling. *Abdomen*: Scales on midline of sterna shorter and less prominent. *Genitalia*: Tergum and sternum IX narrowly fused at base of gonocoxite; tergum without lobes, setal row of opposite sides closely approximated. Gonocoxite with prominent cluster of long setae on tergal margin (= tergal triad of Belkin et al. 1970), these setae inserted in an arc or U-shaped pattern about 0.3 from base. Head of gonostylus primarily divided into 3 lobes; distal tergomesal lobe (possibly homologous to lobes A and M) with relatively large specialized flattened seta (s) on apicatergal area, fringe of short slender and longer bent setae on sternal margin and a prominent curved seta or process (a) on lateral side; lobe B a mesally bent, flattened process arising near middle of lateral side of lobe A,M; lobe C a large flaplike process projecting more or less parallel to stem from its sternal point of attachment between lobes A,M and B. Aedeagus narrow, distinctly longer than wide; apical tergal arms not joined. Proctiger normal; paraproct with rather weakly toothed apex; cercal setae present.

**Pupae.** *Trumpet*: Moderately long, slightly flattened, not laterally expanded; surface sculptured in an imbricated pattern; pinna short, length less than greatest width of meatus. *Abdomen*: Seta 1-I strongly developed; 2-II-VII near posterior margin of tergum, 2-II,VII lateral and 2-III-VI mesal to seta 1; 3-III also mesad of seta 1; 6-VII dorsal, borne caudomesal to seta 9-VII. *Paddle*: Moderately long and broad, length about 1.5 width; apex fringed with tiny spicules.

**Larvae.** *Head*: Longer than wide (head in Fig. 4 drawn from exuviae, dimensions not accurately portrayed). Maxilla broad, width about 0.8 length; cardo incorporated into main body, seta 6 inserted on posterior margin, well developed; laciniastrum 1 comprised of flattened tapered flexible spicules in single row; seta 4

large, split at tip. Seta 6-C on mesal side of straight line drawn between bases of setae 4, 7-C, inserted closer to 7-C; 14-C anterior to seta 15-C, inserted at level of seta 12-C. *Antenna*: Bent slightly near base; seta 1-A inserted at or before midlength. *Thorax*: Seta 1-P well mesad and caudad of 2,3-P, not borne on plate; 11-P, M, T well developed, with multiple branches. Seta 7-M not strongly developed, single. Seta 4-T developed similar to 1-T; 8-T borne laterally between bases of 7-T and metapleural setal group (9-12-T); 13-T significantly longer than thorax. *Abdomen*: Seta 1-I, II well developed, multiple, developed like 2-III-VII; 1-III-VI very long, single, borne on basal plate; 2-I-VII well developed, with multiple branches, 2-III-VII mesad and on same level or slightly posterior to seta 1; 9-I-VI well developed, with multiple branches; setae 7, 13-II more or less on same level, 13-III-VI distinctly posterior to seta 7. *Segment VIII*: Ventral comb scales small and fringed with spicules, becoming larger and progressively spinelike dorsally. *Siphon*: Moderately long, sharply tapered, apical diameter 0.2 of basal diameter, without pecten. Seta 1-S inserted near base of siphon and slightly dorsad of most proximal element of setal group 1a; 1a, 2a-S each comprise a more or less straight row of long, single, aciculate setae, most proximal element of 2a slightly dorsad of others. *Segment X*: Saddle without spicules on posterior margin. Seta 4-X developed like 1-3-X, very long, single or double.

**Systematics.** Species of the genus *Wyeomyia* are currently grouped into 11 subgenera: *Antunesmyia* Lane and Cerqueira, *Caenomyiella* Harbach and Peyton, *Cruzmyia* Lane and Cerqueira, *Decamyia* Dyar, *Dendromyia* Theobald, *Dodecamyia* Dyar, *Exallomyia* Harbach and Peyton, *Menolepis* Lutz, *Nunezia* Dyar, *Wyeomyia* Theobald, and *Zinzala* Zavortink. Of these, only *Caenomyiella*, *Exallomyia*, and *Zinzala* are thoroughly characterized in the immature stages and are known to represent natural groups of species. The other subgenera are based primarily on superficial features of the adults and appear to represent heterogeneous groups of species. While no single life stage can provide a sufficient basis for establishing species relationships, it is obvious that thorough study of the immature stages is necessary before

a natural classification can be established for the genus *Wyeomyia*. Until a natural classification is achieved, it will not be possible to determine the affinities of *Exallomyia*.

The distinctive morphology of the male genitalia and the larva of the species included in *Exallomyia* have contributed substantially to its recognition as a separate subgenus. The homogenous male genitalia exhibit several synapomorphies that distinguish the group. Most obvious among these are the prominent tergo-mesal group of setae on the gonocoxite, the flaplike form of lobe C on the gonostylus, and the lobeless tergum IX with its closely approximated rows of setae. Synapomorphies among the larvae include the distinctive structure of the maxilla, the position and development of seta 1-A, the positional relationships of setae 14, 15-C and 1, 2-I-VII, and the development of setae 1-II-V and 4-X.

Two phyletic lines are recognizable within the subgenus. One includes *tarsata* and *carrilloi* and the other is represented by *arborea*. *Wyeomyia tarsata* and *carrilloi* are clearly closely related on the basis of remarkable similarity in the male genitalia. Males of these two species also bear a specialized "paddle" of erect scales on midtarsomere 2. *Wyeomyia arborea* appears to be the most divergent member of the group as indicated by the development of several features of the male genitalia and the distinctive metallic scaling of the head and thorax.

The larvae of only two of the three species of *Exallomyia* are currently known, and few qualitative differences have been observed between them. This suggests a considerable amount of evolutionary conservatism among species of the group.

**Etymology.** The subgeneric name is derived from the Greek *exallos* (quite different) prefixed to the stem *Myia* (fly) in reference to the distinctness of the group. It is feminine in gender. The three-letter abbreviation *Exm.* is recommended for this subgenus.

***Wyeomyia (Exallomyia) tarsata* Lane and Cerqueira**

*tarsata* Lane and Cerqueira, 1942:612. Holotype male: Anápolis, Goiás, Brazil (IOC).

*Wyeomyia (Dendromyia) tarsata* of Cerqueira 1943:22 (Bolivia; coll. rec.); Lane 1953:867, 870, 992-994 (Brazil; ♀, ♂\*); Horsfall 1955:329 (Brazil); Stone et al. 1959:87 (Brazil, Bolivia; info. on type); Barreto and Lee 1969:418 (Colombia; coll. rec., ♀ bionomics note); Belkin et al. 1971:12 (Brazil; info. on type, L bionomics); Knight and Stone 1977:331 (Brazil, Bolivia, Colombia; info. on type, lit.); Harbach and Peyton 1991:150 (tax. note).

**Female.** Known from the allotype and one specimen from western Brazil. **Head:** Dark scales with bluish reflections, pale scales white. Antenna brown; length 1.75-2.00 mm; pedicel large. Proboscis entirely dark-scaled; length 2.0-2.1 mm, about 0.9 length of forefemur. Maxillary palpus short, length 0.25-0.28 mm, about 0.15 length of proboscis; dark-scaled. **Thorax:** Integument brown; dark scaling with dull bluish reflections, pale scaling white, including a few scales on anterior promontory. Setae of scutum, scutellum, mesopostnotum and anteprenotum dark brown; pleural setae yellowish: 10-12 median anterior promontory, 8-10 mesopostnotal, 9-10 anteprenotal, 2 upper

proepisternal, 2 prespiracular, 3 prealar, 3 lower mesokatepisternal, and 10-13 upper mesepimeral reaching margin of mesopostnotum. Posterior margin of metapostnotum before lower edge of abdominal tergum I with cluster of erect, posteriorly directed, white spatulate scales. **Wing:** Length 3.35 mm. **Legs:** Femora and tibiae white-scaled beneath, legs otherwise dark-scaled with bluish reflections. **Abdomen:** As described for the subgenus.

**Male.** Known only from the holotype. Same as female except as follows. **Head:** White scaling with light blue hue, distinctly blue from lateral aspect. Antenna length 1.63 mm. Proboscis with ventral surface completely pale-scaled, pale scales mainly yellow, whitish basally. Maxillary palpus slightly shorter, nearly 0.08 mm, about 0.4 length of proboscis. **Thorax:** Numbers of setae: 12 median anterior promontory, 8 mesopostnotal, 9 anteprenotal, 2 upper proepisternal, 2 prespiracular, and 1 prealar. **Wing:** Length 3.15 mm. **Legs:** Midtarsus (Fig. 1) with white scaling on ventral surface of tarsomere 1, proximal 0.1 of tarsomere 2 and proximal 0.75 of tarsomere 3; distal 0.9 of midtarsomere 2 with specialized fringe (paddle) of black

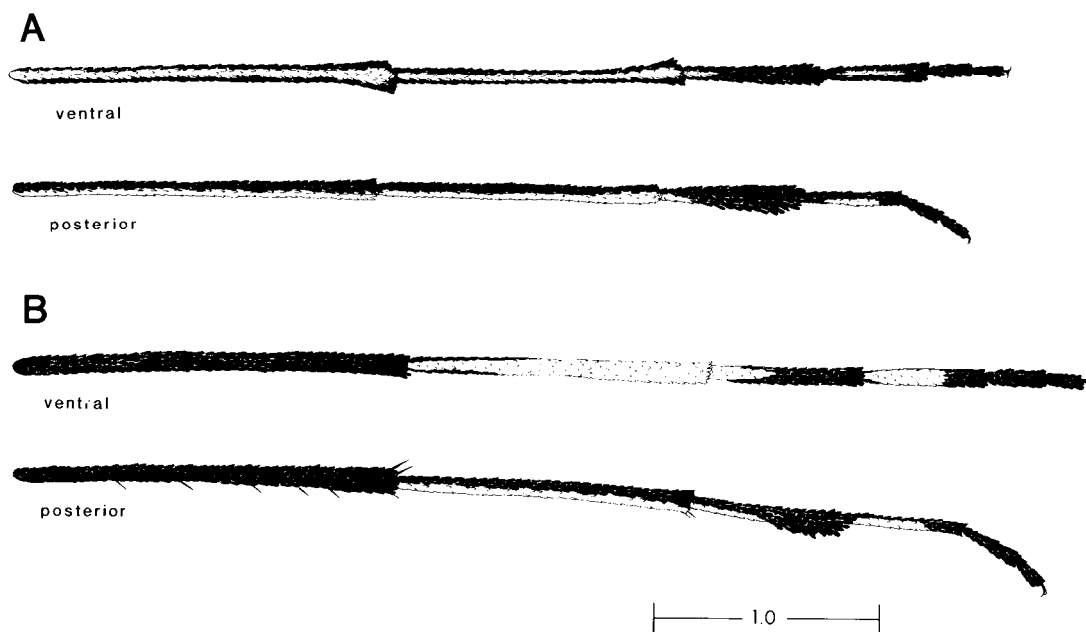


Fig. 1. Midleg (tibia and tarsus) of male. A. *Wyeomyia (Exm.) tarsata*. B. *Wyeomyia (Exm.) carrilloi*.

scales projecting from ventral surface; midtarsomere 5 laterally compressed. Hindtarsus with white scaling on ventral surface of tarsomeres 1 and 2. **Genitalia** (Fig. 2): Tergum IX with 5 flattened, distally bent setae on either side of midline, setae bend away from midline and are progressively shorter laterally. Gonocoxite elongate, length 0.54 mm, broadest in middle and tapering toward each end; setal cluster on tergal margin with about 60 setae inserted in U-shaped pattern, individual setae nearly length of gonostylus, a few basomesal ones much shorter; lateral, sternal and mesal surfaces largely covered with short setae and small spatulate scales; basal mesal lobe roughly rectangular, covered with short needlelike setae and bearing 2 longer setae on caudolateral corner. Gonostylus nearly length of gonocoxite; stem long, nearly straight and slightly enlarged distally; head as figured (except for a few missing modified setae in the lateral and mesal views of the left and right sides, the result of remounting), about 0.2 length of stem; lobe A,M relatively large, seta *a* rather long and flattened distally, seta *s* thumblike and striated distally; lobe B an undulated flaplike process with narrowed apex bearing a brushlike cluster of spicules; lobe C a broad flexible membranous process about 0.5 length of stem. Aedeagus slightly wider in middle, lateral surface not evenly rounded, angled distally; median sternal plate flared distally. Proctiger with 5 minute cercal setae on each side near apex of paraproct.

**Systematics.** *Wyeomyia tarsata* is undoubtedly most closely related to *carrilloi* since the very remarkable morphological congruence of the male genitalia in the two forms is a clear indication of common ancestry. The form of the aedeagus, the development of lobe B of the gonostylus, the amount of pale scaling on the proboscis, and the character of midtarsomere 5 easily distinguish the males of these species. The female of *carrilloi* and the larval and pupal stages of *tarsata* are unknown.

**Bionomics.** Limited information is available on the bionomics of this species. The two adult specimens of the type series were reared from larvae collected from a tree hole ("jenipapeiro," *Genipa americana* L.) in association with *Aedes* (*Howardina*) *fulvithorax* (Lutz). Cerqueira (1943) inferred that specimens were included among a

total of 35,746 adult mosquitoes captured by human and animal bait, during the daytime, in three different sites in northern Bolivia. Barreto and Lee (1969) captured five specimens while biting man in the Rio Raposo region of the Pacific Coast of Colombia, but this collection could well have been *carrilloi* and needs confirmation.

**Distribution.** *Wyeomyia tarsata* is recorded from the type locality of Anápolis, State of Goiaz, in central Brazil, Curralinho, State of Pará, in northern Brazil (Lane and Cerqueira 1942), and Costa Marques, State of Rondonia in western Brazil (new record); three localities within the Territorio de Colonias in northern Bolivia (Cerqueira 1943); and the Rio Raposa region on the Pacific coast of Colombia (Barreto and Lee 1969).

**Material examined.** 4 specimens (2 females, 1 male, 1 male genitalia). BRAZIL: Goiaz, Anápolis, September 1936, 1♀ (8155) (allotype); 1♂ (8155), 1♂ genitalia (2079) (holotype) [IOC]. Rondonia, 7 km N.W. of Costa Marques, 16-17 November 1986, malaise trap, R. Wilkerson, 1♀ [NMNH].

*Wyeomyia* (*Exallomyia*) *carrilloi* (Sutil O. and Pulido F.)

*carrilloi* Sutil O. and Pulido F., 1978:199 (*Sabethes*). Holotype male: Guaca, Municipio San Antonio de Caparo, Táchira, Venezuela (DERM). NEW COMBINATION.

*Sabethes carrilloi* of Harbach and Peyton 1991:150 (tax. note).

*Sabethes* (*Sabethes*) *carrilloi* of Ward 1984:250 (info. on type).

**Female.** Unknown.

**Male.** Known only from the holotype. Differing from *tarsata* primarily in the following features. **Head:** White scales without light blue hue. Antenna length 1.5 mm. Proboscis mainly dark-scaled with white scaling on basal 0.2 of ventral surface; length 1.75 mm, about 0.8 length of forefemur. **Wing:** Length 2.95 mm. **Legs:** Fore- and midtibiae entirely dark-scaled, hindtibia pale beneath; midtarsus (Fig. 1) with same pattern of pale scaling but paddle of tarsomere 2 shorter, on distal 0.6 of ventral surface, and

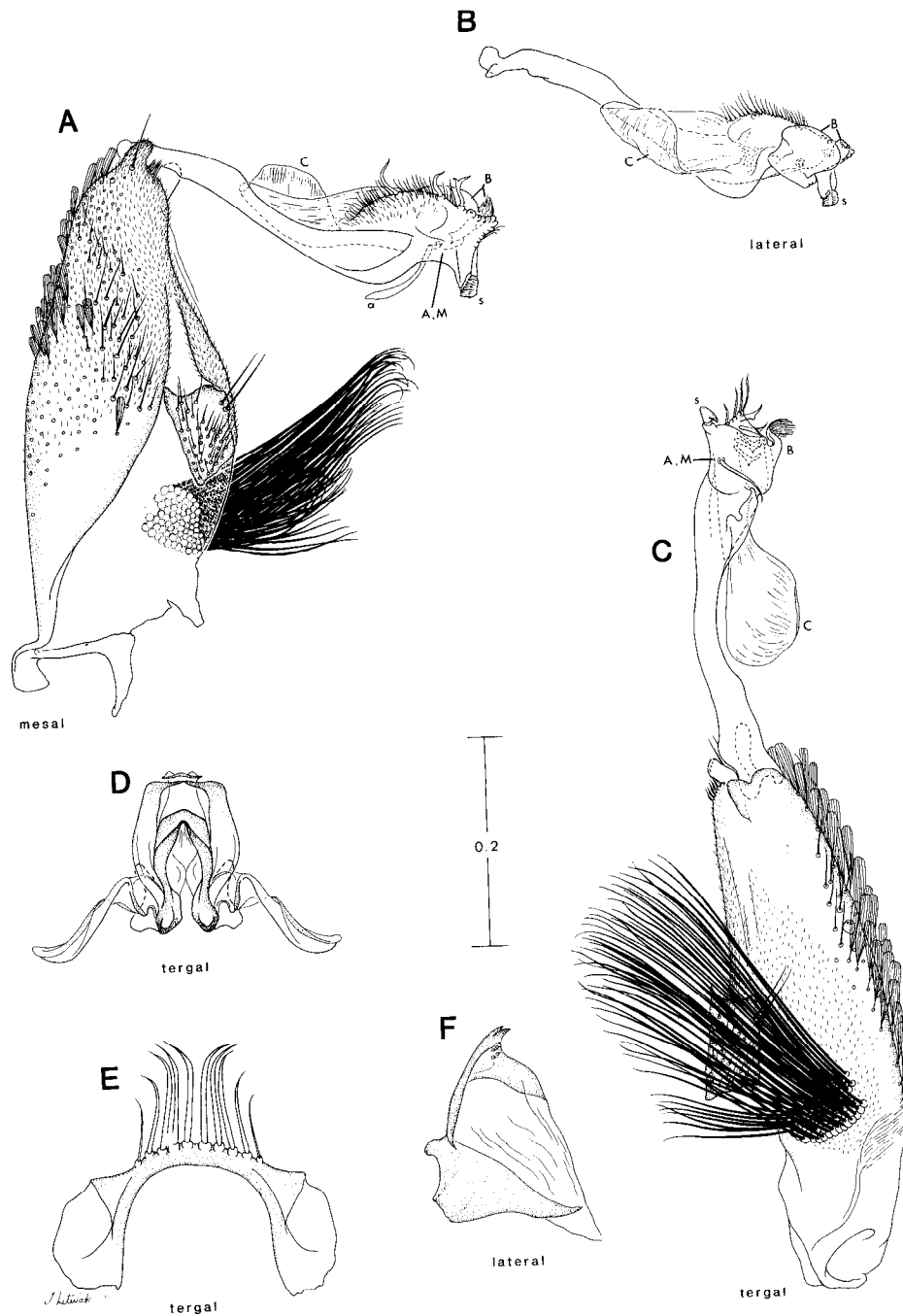


Fig. 2. *Wyeomyia (Exm.) tarsata*, genitalia of holotype male. A,B, Right gonocoxopodite and left gonostylus, respectively, after removal, separation, and repositioning of gonocoxopodites on original slide. C, Original orientation of right gonocoxopodite on slide (originally connected at basal mesal lobe to mate of opposite side). D-F, Aedeagus (D), tergum IX (E), and left paraproct (F) in their unaltered positions on the original slide.

tarsomere 5 normal, not laterally compressed. **Genitalia** (Fig. 3): Essentially as described for *tarsata* except for the following differences. Tergum IX with 4 setae on either side of midline which are less obviously flattened. Gonocoxite with fewer setae in tergal cluster, approximately 30. Seta a of gonostylus smaller, simple (alveolus shown in figure, seta missing from dissected genitalia on slide but illustrated by Sutil O. and Pulido F. 1978); lobe B smaller, apex slightly expanded but flat, without spicules. Aedeagus nearly oval in tergal view, lateral surface with even contour. Proctiger with 4 cercal setae on each side.

**Pupa** (Fig. 3). Known from only one exuviae of a female; character and positions of setae as figured, numbers of branches in Table 1. **Cephalothorax**: Lightly tanned. Seta 1-CT very long, double, sigmoid; 5-CT long, single. **Trumpet**: Yellow; index 5.53 (width measured at mid-length). **Abdomen**: Lightly to moderately tanned, anterior margins of sterna II-VI darker; terga and sterna II-VIII covered with minute needle-like spicules; length about 4.0 mm. Seta 5-IV-VI (missing from IV on available specimen, but shown same as on V, VI in original description) distinctly longer than following tergum; 6-II single, longer than following tergum, at level of seta 9; 6-II-VI double, posterior to seta 9, more or less at level of seta 7; 7-II ventral; 9-VII with 9 branches, as long as following tergum, 9-VIII slightly shorter than paddle. **Genital lobe**: Lightly tanned; length about 0.3 mm. **Paddle**: Lightly tanned; about twice length of genital lobe, index 1.53.

**Larva** (Fig. 4). Described from exuviae attributed to holotype; character and positions of setae as figured, numbers of branches in Table 2; structural integrity and setal positions correlated with a third instar. **Head**: Lightly to moderately tanned; hypostomal suture complete, gently curved and extending more or less diagonally to posterior tentorial pit which is just cephalad of caudal margin of capsule; collar essentially absent, ventrolateral margin slightly produced and darkly tanned; slits of occipital foramen extending to lateral margin of capsule just caudad of seta 10, margin darkly tanned at lateral end of slit. Dorsomentum with 1 large central tooth and 10 pairs of smaller lateral teeth. Maxilla as figured; elements of lacinia-

rastrum 1 rather long, longest elements about 0.6 greatest width of maxilla; seta 6 with 7 branches arising from short stem. Seta 1-C long and relatively slender; 4-6-C subequal, single, simple; 5-C well caudad; 7-C multiple, with 4,5 branches; 8-C short, double; 10-C double, divided at midlength; 11-C well developed, fanlike, with 13,16 aciculate branches; 14-C strongly developed, about 0.5 length of head, with 4 branches. **Antenna**: Short, about 0.2 length of head, moderately tanned. Seta 1-A well developed, with 7,8 branches, inserted about 0.4 from base of antenna; 2-A long, base swollen; 3-6-A peg-like; 5-A with lateral digiform branch above base, longer than 3,4,6-A, about 0.6 length of 2-A. **Thorax**: Integument hyaline, smooth. Setae 4-P, 8-M and 7,13-T on small basal plates; 5-7-P, 5,6-M and pleural groups 9-12-P,M,T on common basal plates. Setae 0,1,8-P, 1,13,14-M and 1,4,5-T multibranched and stellate; 2-P considerably longer than 3-P, nearly as long as 4-P; 11-P,M,T triple, 11-P with 4 branches on one side; seta 14-M significantly longer and more branched than 14-P. **Abdomen**: Integument hyaline, smooth. Setae 1,2,5,7,9,11,13-I-VII generally multibranched and stellate; seta 5 long, progressively longer from segments I to III, length decreasing very slightly from segments III to VI, 5-III,IV distinctly longer than seta 13 of same segment; 11-I,VI,VII longer than 11-II-V, 11-I developed like 13-I; 13-II-V long, about same length as segment, borne on basal plate; 13-VII distinctly longer than segment, also borne on basal plate, double. **Segment VIII**: Comb with 43/48 (?) scales in partially double row (some scales may belong to opposite side of exuviae which is compressed and twisted, original description says "in a row of more than 20 spines" and illustration shows 24 in single row); scales short and rather broad ventrally, becoming longer and more spinelike dorsally, all distally fringed with short, close-set, ill-defined spicules. Seta 5-VIII very long, double, one branch longer than the other. **Siphon**: Index about 5.1 (width measured at base); surface smooth, moderately tanned, basal margin dark. Seta 1-S double/triple; 1a,2a-S aciculate. **Segment X**: Saddle narrowly incomplete ventrally; lightly tanned; lateral surface with short rows of minute spicules, dorsal surface smooth; length 0.28 mm, siphon/saddle index about 5.1. Setae 1,3,4-X

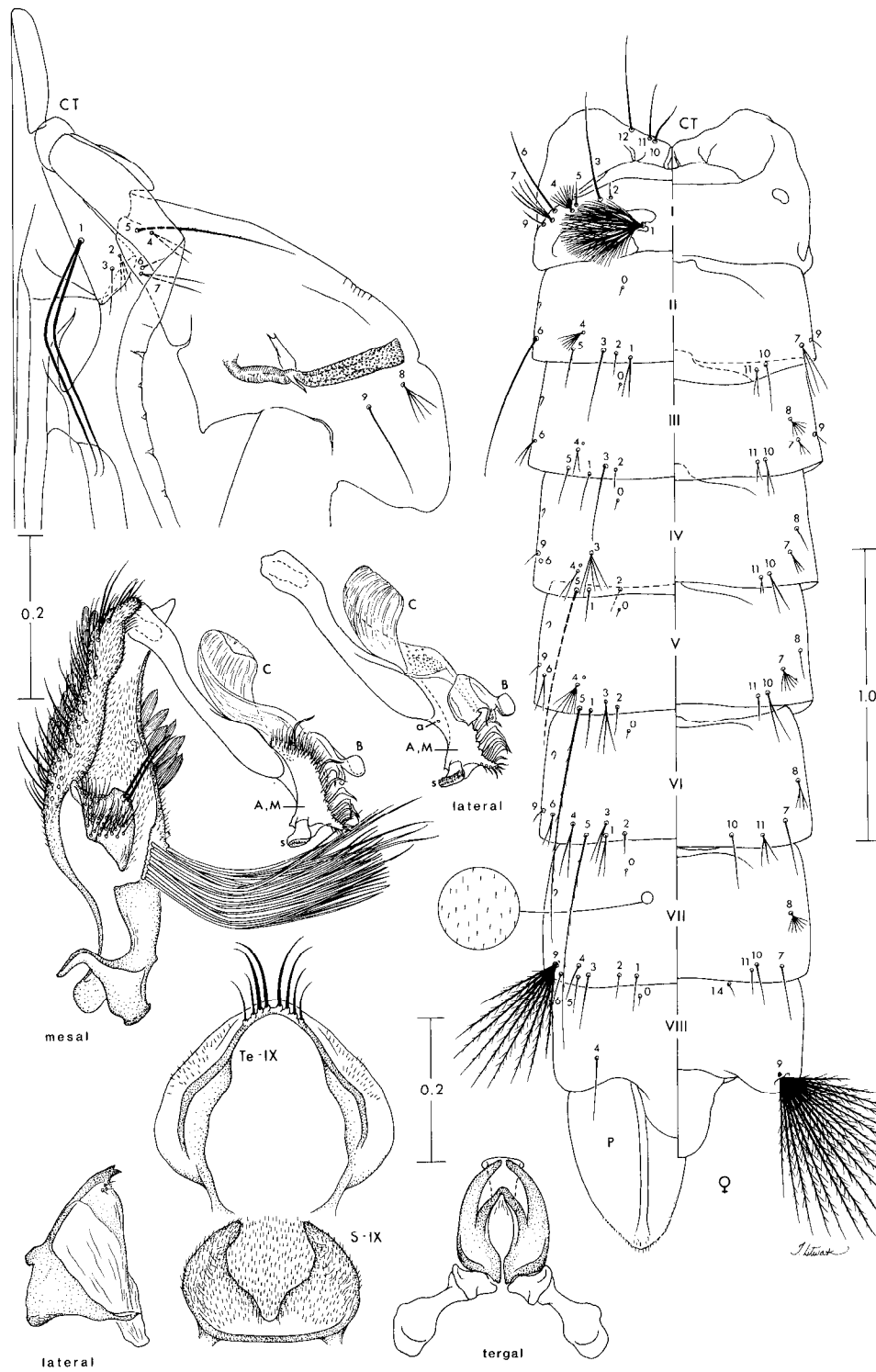


Fig. 3. *Wyeomyia (Exm.) carrilloi*, pupa and genitalia of holotype male.

**Table 1.** Numbers of branches for pupal setae of *Wyeomyia (Exm.) carrilloi* (one specimen).

Seta no.	Cephalothorax	Abdominal segments			
	CT	I	II	III	IV
0	-	-	1/1	1/1	1/1
1	2/2	- 130	2/2	1/1	1/1
2	3/2	1/1	1/1	1/1	-/-
3	1/1	1/1	1/1	1/1	5/5
4	2/2	9/8	6/6	2/3	2/2
5	1/1	1/1	-/1	1/1	-/-
6	1/1	1/1	1/1	2/2	-/-
7	3/2	4/5	3/3	2/2	3/3
8	4/4	-	-	3/6	1/1
9	1/1	1/1	1/1	1/1	1/1
10	1/1	?	1/1	2/2	2/2
11	1/1	?	2/3	1/2	2/2
12	1/1	-	-	-	-
13	-	-	-	-	-
14	-	-	-	-	-

Seta no.	Abdominal segments					Paddle P
	V	VI	VII	VIII	IX	
0	1/1	1/1	1/1	1/1	-	-
1	1/1	2/1	1/1	-	-	-
2	1/1	1/1	1/1	-	-	-
3	3/2	2/2	1/1	-	-	-
4	6/4	2/3	1/1	1/1	-	-
5	1/1	1/1	1/1	-	-	-
6	2/2	2/2	1/1	-	-	-
7	4/6	1/1	1/1	-	-	-
8	1/1	2/4	8/6	-	-	-
9	1/1	1/1	9/9	19/18	-	-
10	2/2	1/1	1/1	-	-	-
11	1/1	2/3	2/1	-	-	-
12	-	-	-	-	-	-
13	-	-	-	-	-	-
14	-	-	-	1/1	-	-

single (1,4-X missing in exuviae attributed to holotype); 2-X double.

**Systematics.** From the original description, it appears that *carrilloi* was described from the holotype male, an unspecified number of pupal specimens, and four larval specimens. With the

help of Yasmin Rubio, we borrowed the type material of this species from the Laboratorio de Entomología, División de Endemias Rurales in Maracay, Venezuela for study. This material included the holotype male on a pin (number 2474-2), the dissected genitalia on a slide, and

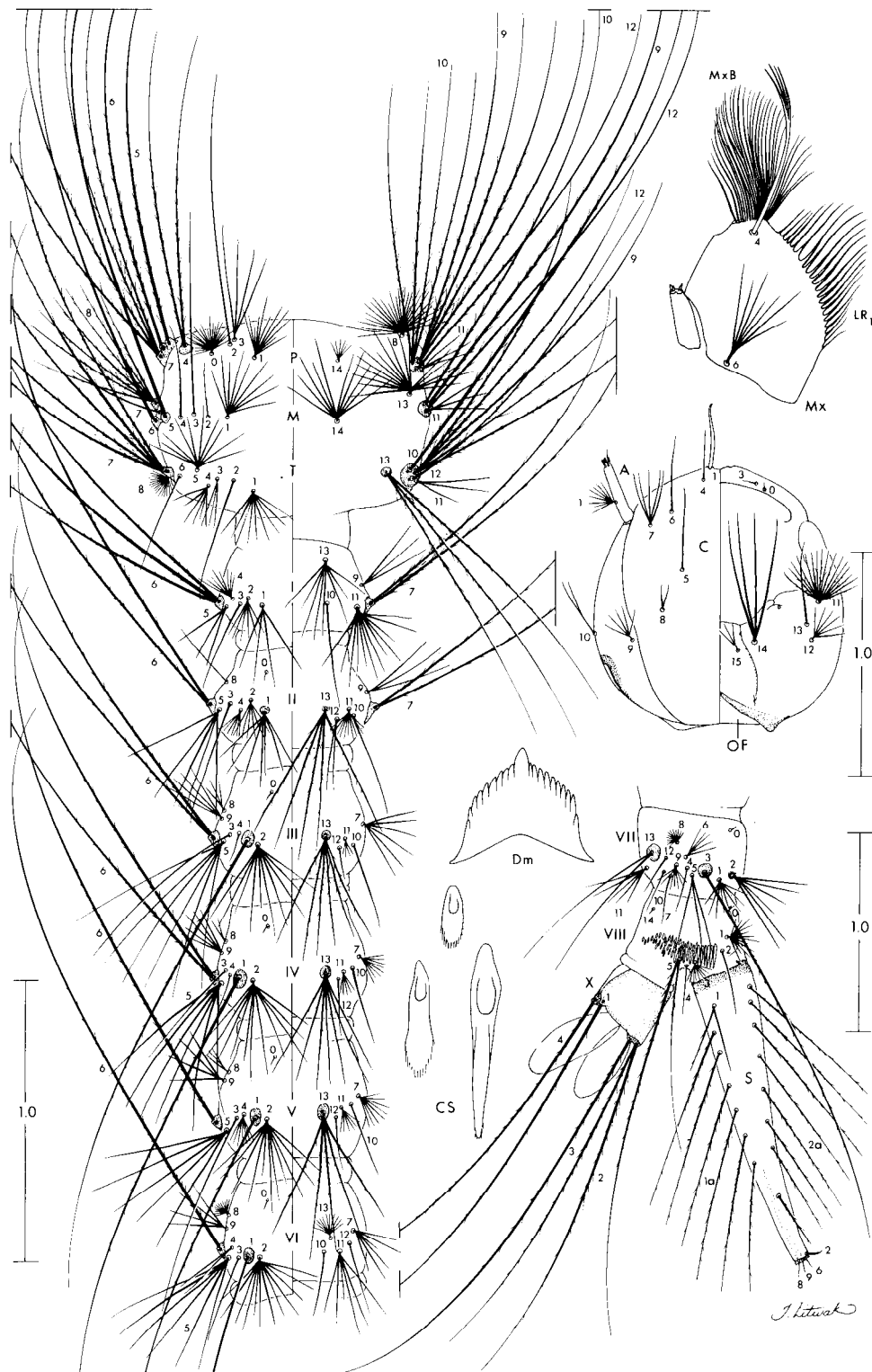


Fig. 4. *Wyeomyia (Exm.) carrilloi*, larva of holotype male (reconstructed from larval exuviae by comparison with a third instar larva).

**Table 2.** Numbers of branches for fourth-instar larval setae of *Wyeomyia (Exm.) carriloi* (holotype male).

Seta no.	Head	P	Thorax		Abdominal segments		
	C		M	T	I	II	III
0	1/1	20/21	-	-	-	1/1	1/1
1	1/1	11/11	9/9	9/7	-/4	7/8	-/1
2	-	1/1	1/1	1/1	6/6	6/4	11/10
3	1/1	4/4	1/1	2/3	1/1	1/1	1/1
4	1/1	2/2	1/1	5/6	8/7	5/6	1/1
5	1/1	1/1	-/1	11/10	3/3	6/6	7/6
6	1/1	1/-	-/-	1/1	-/-	2/2	-/2
7	5/4	-/4	1/1	5/5	-/3	-/-	5/6
8	2/2	24/21	-/7	24/16	-	1/1	3/-
9	5/4	4/4	1/1	5/6	3/3	3/3	4/4
10	2/2	4/4	1/1	1/1	1/1	1/1	1/1
11	13/16	4/3	3/3	3/3	12/12	10/10	4/5
12	6/6	1/1	1/1	1/1	-	2/2	1/1
13	1/1	-	14/16	3/4	8/8	4/5	6/8
14	4/4	8/5	11/10	-	-	-	-
15	3/3	-	-	-	-	-	-

Seta no.	Abdominal segments					
	IV	V	VI	VII	VIII	X
0	1/1	1/1	1/1	1/1	1/1	-
1	-/1	-/1	1/2	8/8	12/10	1
2	12/11	13/11	13/12	6/5	1/1	2/2
3	1/1	1/1	1/1	1/1	8/7	1/1
4	1/1	7/8	2/2	1/1	1/1	1
5	6/6	6/5	6/6	3/3	2/2	-
6	2/2	1/1	1/1	6/5	-	-
7	9/8	8/7	6/6	1/1	-	-
8	2/2	3/3	12/11	13/13	1-S	2/3
9	5/5	4/4	4/5	7/6	-	-
10	1/1	1/1	1/1	1/1	-	-
11	5/5	5/6	-/6	5/5	-	-
12	1/1	1/1	1/-	1/2	-	-
13	8/7	5/5	9/11	2/2	-	-
14	-	-	-	-	1/1	-
15	-	-	-	-	-	-

individual larval and pupal exuviae on separate slides, each identified with the same number as the pinned adult. According to Ms. Rubio, these were the only specimens of *carrilloi* in the Laboratorio de Entomologia collection.

The pupal exuviae attributed to the holotype is that of a female. We suspect that the authors of this species did not individually rear the available larval specimens. One larva was a female which reached adulthood; the adult was either destroyed or lost, and the corresponding pupal exuviae was incorrectly associated with the holotype male. The whereabouts of the other specimens mentioned in the original description is unknown.

**Bionomics.** Larvae of *carrilloi* have been collected from a tree hole (type material, Venezuela) and bamboo (Peru). Nothing further is known about the bionomics of this species.

**Distribution.** *Wyeomyia carrilloi* is known from the town of San Antonio de Caparo in the State of Táchira, Venezuela and the National Park of Manu, Department of Madre de Dios, Peru.

**Material examined.** 5 specimens (1 male, 1 male genitalia, 1 pupal exuviae, 1 larval exuviae, 1 third-instar larva). VENEZUELA: *Táchira*, San Antonio de Caparo, Guaca, 1Le♂, 1♂ genitalia (2474-2) (holotype); 1Pe (of ♀, 2474-2) [DERM]. PERU: *Madre de Dios*, Parque Manu, Pakitza, 11° 56' S 71° 18' W, 250 m, water in *Guadua* bamboo internode (16-2), Sep 89, Louton, Bouchard & Gelhaus, 1L (3rd instar) [NMNH].

*Wyeomyia (Exallomyia) arborea* Galindo,  
Carpenter and Trapido

*arborea* Galindo, Carpenter and Trapido, 1951:86.

Holotype male: Bijao, Chiriqui Volcano, Chiriqui Province, Panama (NMNH).

*Wyeomyia arborea* of Galindo and Trapido 1957:146 (Nicaragua; coll. rec.); Harbach and Peyton 1991:150 (tax. note).

*Wyeomyia (Davismyia) arborea* of Lane 1953:867, 870, 874, 878, 936-938 (Panama; ♀, ♂\*, P\*, L\*); Stone et al. 1959:82 (Panama; info. on type, lit.); Belkin et al. 1965:47, 58 (Panama; info. on type, A, L bionomics); Knight and Stone 1977:326 (Panama; info. on type, lit.).

*Wyeomyia arborea* is the most derived species of the subgenus in adult ornamentation. The scaling is generally metallic as in *Sabethes*, but without the brilliant reflections characteristic of the latter.

**Female.** Described from the allotype and 3 paratypes. Differing from *tarsata* in the following features. **Head:** Dark scales with golden, green and blue reflections depending on angle of light but predominantly golden, pale scales silvery white. Antenna 1.63-1.88 mm (mean 1.74 mm), pedicel smaller. Proboscis and maxillary palpus entirely dark-scaled with metallic reflections of blue and violet; proboscis length 2.38-2.50 mm (mean 2.42 mm), essentially same length as forefemur. Maxillary palpus longer, length 0.33-0.38 mm (mean 0.36 mm), about 0.15 length of proboscis. **Thorax:** Scutal scales metallic gold; large silvery-white scales project over paratergite; large scales of supraalar area, prescutellar area and scutellum more typical of *Wyeomyia* in having rather dull bluish to greenish reflections. Dark scales of anteprenotum with metallic blue and violet reflections; scales on lower part of anteprenotum, postprenotum, pleura, coxae and trochanters all silvery white; posterior margin of metapostnotum without a cluster of scales. Thoracic setae: 15 median anterior promontory, 4-7 mesopostnotal, 9-12 anteprenotal, 2,3 (usually 3) upper proepisternal, 2 prespiracular, 2-5 prealar, 4,5 lower mesokatepisternal, and 9-14 upper mesepimeral. **Wing:** Length 3.55-3.73 mm (mean 3.63 mm). **Legs:** Forefemur with pale scaling largely restricted to proximal 0.5 of ventral surface.

**Male.** Based on the holotype and 3 paratypes. Essentially as in the female, with the following differences. Differing from the males of *tarsata* and *carrilloi* in the metallic scaling of the head and thorax, significantly longer maxillary palpus, pale scaling of the proboscis and midleg, absence of a paddle on midtarsomere 2, and the genitalic characters noted below. **Head:** Antenna length 1.35-1.53 mm (mean 1.42 mm). Proboscis with yellowish scaling on distal 0.3 of ventral surface and a small distinct spot at base ventrally; length 2.18-2.43 mm (mean 2.29 mm), slightly if at all longer than forefemur. Maxillary palpus as described for female. **Thorax:** Numbers of setae: 9-13 median anterior promon-

tory, 5,6 mesopostnotal, 8-11 anteprenotal, 2,3 (usually 2) upper proepisternal, 1 prespiracular, 2,3 prealar, 4-6 lower mesokatepisternal, and 10-15 upper mesepimeral. *Wing*: Length 2.90-3.33 mm (mean 3.04 mm). *Legs*: Tarsi all dark as in female, except ventral surface of mid-tarsomere 5 which is pale-scaled. *Genitalia* (Fig. 5): Differing from *tarsata* and *carrilloi* in the following features. Tergum IX with 4-6 flattened, laterally curved setae on either side of midline. Tergal setal cluster of gonocoxite with 10-13 setae inserted in arc or J-shaped row; basal mesal lobe covered with fewer slightly longer setae, caudolateral corner without long setae. Lobe A,M of gonostylus smaller, narrow distally; seta *a* developed as a long, tubular, sternally curved armlike process with slightly expanded tip; seta *s* rather large, sickle-shaped, with fringe of minute spicules on outer margin distally; lobe B about as large as lobe A,M, heavily tanned, distal half bent caudad, narrowed and projecting beaklike beyond tip of lobe A,M; lobe C smaller, bladelike and rigid. Aedeagus relatively narrow, nearly parallel-sided, lateral surface appearing slightly constricted just beyond midlength from tergal aspect. Proctiger with 2 or 3 cercal setae on each side.

**Pupa** (Fig. 5). Character and positions of setae as figured; numbers of branches in Table 3. Very similar to *carrilloi* except for the following. *Cephalothorax*: Seta 5-CT single or double. *Trumpet*: Index 4.42-4.76 (mean 4.60). *Abdomen*: Segments II-VII rather darkly tanned; terga and sterna without covering of minute needlelike spicules; length 3.40-3.98 mm (mean 3.61 mm). Seta 6-II,III single, 6-IV-VI single or double; 9-VII with 9-16(14) branches. *Genital lobe*: Moderately to darkly tanned. Length about 0.3 mm in female, about 0.6 mm in male. *Paddle*: Twice length of genital lobe in female, slightly if at all longer than genital lobe in male; index 1.42-1.61 (mean 1.51).

**Larva** (Fig. 6). Based on exuviae of holotype, allotype, and 1 paratype. Character and positions of setae as figured; numbers of branches in Table 4. Resembling *carrilloi* except for the following primary differences. Most setae proportionately shorter and with fewer branches than in *carrilloi*. *Head*: Dorsomentum with 8-10 teeth on either side of larger central tooth.

Maxilla as figured; elements of laciniastrum 1 shorter and more widely spaced, longest elements about 0.35 greatest width of maxilla; seta 6 with 2-4 branches arising at base. Seta 1-C shorter; 8-C longer, with 3 or 4 branches; 14-C double or triple. *Antenna*: Seta 1-A with 4 or 5 branches, inserted at midlength of antenna. *Thorax*: Seta 14-P,M similar in length and number of branches. *Abdomen*: Seta 2-I-VII with significantly fewer branches; 13-VII single. *Segment VIII*: Comb with 20-25 scales in a single row; ventral scales completely fringed with tiny spicules, dorsal scales spinelike with spicules on sides at base. *Siphon*: Shorter, index 3.50-4.63 (mean 4.08); surface with rows of minute spicules except distally. Seta 1-S single or double (double on one side of one specimen). *Segment X*: Saddle/siphon index about 4.1. Setae 1,2-X single or double; 4-X double or triple (triple on one side on one specimen).

**Systematics.** *Wyeomyia arborea* was originally placed in the subgenus *Davismyia* Lane and Cerqueira, which was recently transferred from *Wyeomyia* to *Sabethes* (Harbach and Peyton 1991). Adults of this species are easily separated from those of *Sabethes petrocchiai* (Shannon and del Ponte), the only species of the subgenus *Davismyia*, by the less pronounced metallic reflection of the scutal scales, proboscis distinctly longer than the forefemur, and the presence of one or two setae on the margin of the upper calypter. *Sabethes petrocchiai* is the only species of *Sabethes* known to possess prealar setae.

The microscope slide with the larval exuviae of the allotype female of *arborea* also bears the pupal exuviae of a male. Since one paratype male (No. 5) was reared from a pupa and the corresponding microscope slide bears the exuviae of a female, it appears that the pupal exuviae of this specimen and the allotype were confused and wrongly associated by the authors of this species (Galindo et al. 1951).

**Bionomics.** The holotype and two paratype males were reared from eggs laid by a female collected biting man in the upper canopy of forest in Panama (45 feet above the ground on the slopes of Chiriqui volcano, 3,000 feet elevation); the allotype and one paratype male were reared from immatures collected in a bamboo internode used as a larval trap in the upper

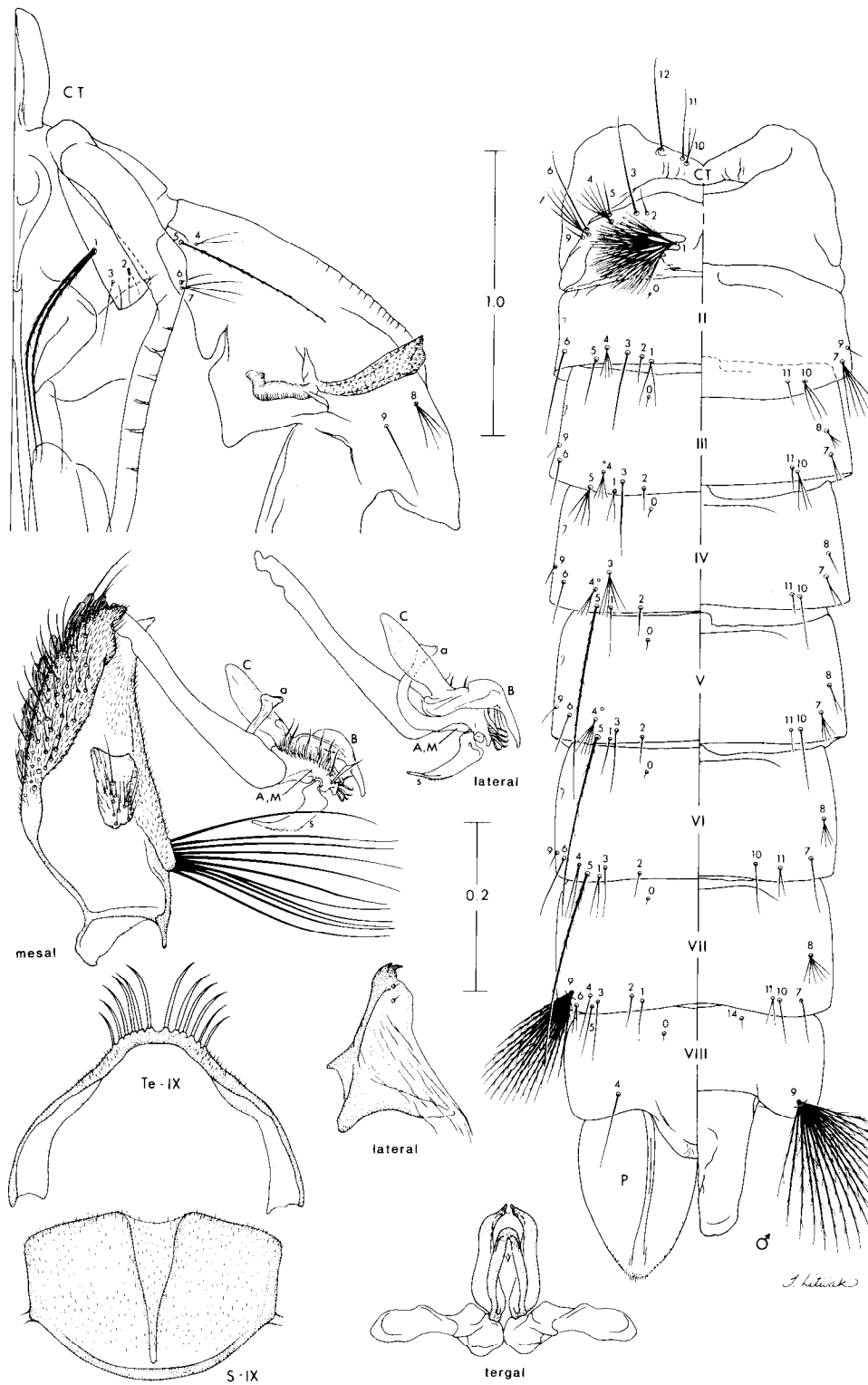


Fig. 5. *Wyeomyia* (Exm.) *arborea*, pupa and male genitalia (composites).

**Table 3.** Numbers of branches for pupal setae of *Wyeomyia (Exm.) arborea* (four specimens).

Seta no.	Cephalothorax	Abdominal segments			
	CT	I	II	III	IV
0	-	-	1	1	1
1	2	- 120	2-7(3)	2,3(2)	1
2	2,3(2)	1	1	1	1
3	1	1	1	1	3-5(5)
4	1-3(2)	4-8(5)	3-6(6)	2,3(3)	2,3(2)
5	1,2(1)	1,2(1)	1,2(2)	2-4(2,3)	1
6	1,3(1)	1	1	1	1,2(1,2)
7	2-4(2)	1-4(3)	4-6(5)	2-4(3,4)	1-3(2)
8	3-5(4)	-	-	2-5(2)	1,2(1)
9	1	1-3(1,2)	1	1	1
10	1,2(2)	?	1-3(2)	1-3(2)	1,2(2)
11	1	?	1	1,2(1)	1
12	1,2(1)	-	-	-	-
13	-	-	-	-	-
14	-	-	-	-	-

Seta no.	Abdominal segments				Paddle P
	V	VI	VII	VIII	
0	1	1	1	1	-
1	1,2(1)	1,2(1,2)	1	-	-
2	1,2(1)	1	1	-	-
3	1-4(1)	1,2(2)	1	-	-
4	2-5(3,4)	1,2(2)	1	1	-
5	1	1	1	-	-
6	1,2(1)	1,2(1)	1-3(2)	-	-
7	4-6(5)	1	1	-	-
8	2	2-4(3)	5,6(6)	-	-
9	1	1	9-16(14)	16-20(16)	-
10	1	1	1	-	-
11	1	1,2(2)	1,2(1)	-	-
12	-	-	-	-	-
13	-	-	-	-	-
14	-	-	-	1	-

canopy at the type locality; and one male and one female were captured with a net from the branches of a tree 30 feet above the ground on the forested slopes of Cerro Tute near Santa Fe (2,200 feet elevation) (Galindo et al. 1951). Galindo and Trapido (1957) reported the cap-

ture of one female biting man in the canopy of forest during daytime near Villa Somoza in Chontales Province, Nicaragua. Nothing else is known about the bionomics or disease relations of this species.

**Distribution.** *Wyeomyia arborea* is known

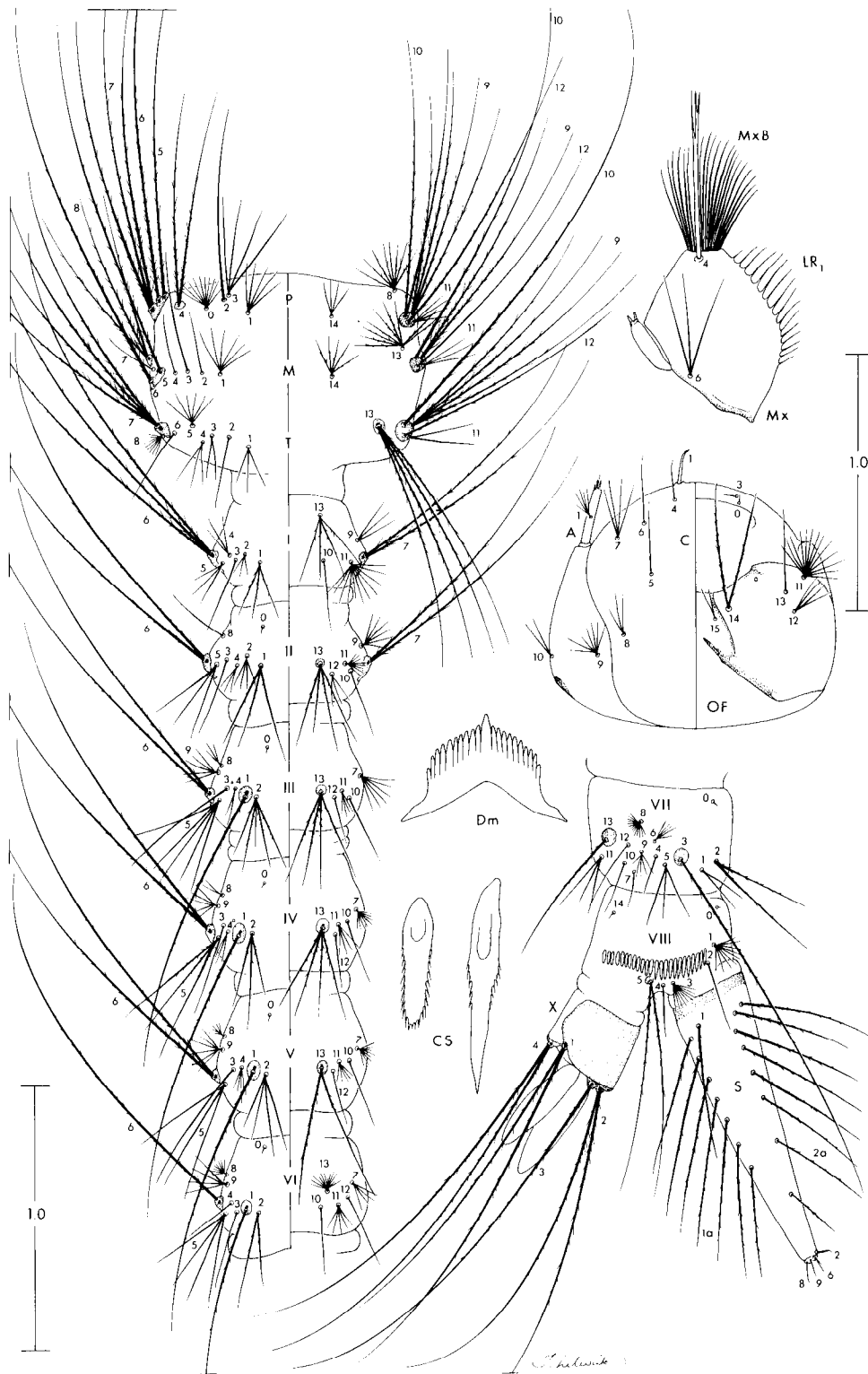


Fig. 6. *Wyeomyia (Exm.) arborea*, larva (reconstruction based primarily on exuviae of paratype male no. 1).

**Table 4.** Numbers of branches for fourth-instar larval setae of *Wyeomyia (Exm.) arborea* (three specimens, two incomplete).

Seta no.	Head	P	Thorax		I	Abdominal segments	
	C		M	T		II	III
0	1	9,10(10)	-	-	-	1	1
1	1	4,5(4)	5,6	3,4(3)	2,3(3)	2,3(2)	1
2	-	1	1	1	3	2,3(2)	4,5(4)
3	1	3-5(4)	1	2	1	1	1
4	1	2	1	3	3,4(3)	3	2,3(2)
5	1,2(1)	1	1	5,6	3,4(3)	3,4	3-5(4)
6	1	1	1	1	2,3(3)	2	2
7	3,4(3)	3,4	1	3,4(3)	2	2	6,7(6)
8	3,4(3)	7-10	3	7-9(9)	-	1	3,4
9	7,8(8)	4	1,2(2)	3,4(4)	2,3(2)	4-6(6)	4-7(6)
10	2,3(2)	2	1	1	1	1	1
11	13-16(13)	3,4(3)	3	2,3(2)	5-11	4-7(4)	4,5(4)
12	4,5(5)	1	1	1	-	2,3	1
13	1,2(1)	-	6-9	3,4(4)	3-5(4)	3,4(3)	4,5(4)
14	2,3(3)	4-6(6)	5-7	-	-	-	-
15	2-4	-	-	-	-	-	-

Seta no.	Abdominal segments					
	IV	V	VI	VII	VIII	X
0	1	1	1	1	1	-
1	1	1	2,3	2	7,8(7)	1,2(2)
2	3,4(4)	3,4(4)	1	1,2	1	1,2(2)
3	1	1	1	1	9	1
4	2-4(2)	3,4	1	1,2(2)	1	2,3(2)
5	3,4(3)	3,4	4	2,3	2	-
6	2	1,2	1	6,7	-	-
7	6-8	7,8	4	1	-	-
8	3	3,4	8	10	1-S	1,2(1)
9	4-6(5)	4-6	4,5	5	-	-
10	1	1	1	1	-	-
11	3-5(4)	4	4,5	3	-	-
12	1	1	1	1	-	-
13	4,5(4)	2	11-13	1	-	-
14	-	-	-	-	1	-
15	-	-	-	-	-	-

from the two western provinces of Chiriqui and Veraguas in Panama, and Chontales Province in Nicaragua.

**Material examined.** 18 specimens (4 females, 4 males, 3 male genitalia, 3 larval exuviae, and 4 pupal exuviae) including 4 individual rearings. PANAMA: *Chiriqui Province*, Bijao, VI-15-50, 1♀ (paratype); VI-20-50, 2♀ (paratypes); VII-11-50, 1Pe (of ♀, probably allotype), 1♂ (paratype no. 5), 1Le♀ (allotype), 1Pe (of ♂, on slide with Le of allotype ♀, probably paratype no. 5); VIII-15-50, 1PeLe♂, 2♂ genitalia (holotype and paratype no. 1). *Veraquas Province*, Santa Fe, VII-11-50, 1♂, 1♂ genitalia (paratype no. 4) [NMNH].

### ACKNOWLEDGMENTS

The authors are grateful to Yasmin Rubio, Ministry of Health and Social Welfare, Maracay, Venezuela and Ricardo de Oliveira, Ministry of Health, Fundacao Oswaldo Cruz, Rio de Janeiro, Brazil for arranging loans of type specimens for this study; Richard C. Wilkerson, Ronald A. Ward, and Jayson I. Glick for reviewing the manuscript; Taina Litwak for preparing the illustrations; and James E. Pecor for assisting with the typing of the manuscript.

### REFERENCES CITED

- Barreto, P. and V.H. Lee. 1969. Arthropodos hematofagos del Rio Raposo, Valle, Colombia. II -- Culicidae. *Caldasia* 10:407-440.
- Belkin, J.N., R.X. Schick and S.J. Heinemann. 1965. Mosquito studies (Diptera, Culicidae) V. Mosquitoes originally described from Middle America. *Contrib. Am. Entomol. Inst. (Ann Arbor)* 1(5):1-95.
- Belkin, J.N., S.J. Heinemann and W.A. Page. 1970. Mosquito studies (Diptera, Culicidae) XXI. The Culicidae of Jamaica. *Contrib. Am. Entomol. Inst. (Ann Arbor)* 6(1):1-458.
- Belkin, J.N., R.X. Schick and S.J. Heinemann. 1971. Mosquito studies (Diptera, Culicidae) XXV. Mosquitoes originally described from Brazil. *Contrib. Am. Entomol. Inst. (Ann Arbor)* 7(5):1-64.
- Cerqueira, N.L. 1943. Lista dos mosquitos da Bolivia (Diptera, Culicidae). *Mem. Inst. Oswaldo Cruz Rio De J.* 39:15-36.
- Galindo, P. and H. Trapido. 1957. Forest mosquitoes associated with sylvan yellow fever in Nicaragua. *Am. J. Trop. Med. Hyg.* 6:145-152.
- Galindo, P., S.J. Carpenter and H. Trapido. 1951. Descriptions of two new species of *Wyeomyia* and the male of *Sabethes tarsopus* Dyar and Knab (Diptera, Culicidae). *Proc. Entomol. Soc. Wash.* 53:86-96.
- Harbach, R.E. 1991. A new subgenus of the genus *Sabethes* (Diptera: Culicidae). *Mosq. Syst.* 23:1-9.
- Harbach, R.E. and E.L. Peyton. 1990. A new subgenus in *Wyeomyia* (Diptera: Culicidae), with the reclassification and redescription of the type species, *Sabethes fernandezyepezi*. *Mosq. Syst.* 22:15-23.
- Harbach, R.E. and E.L. Peyton. 1991. Transfer of the subgenus *Davismyia* from *Wyeomyia* to *Sabethes* and description of the type species, *Miamyia petrocchiaie* (Diptera: Culicidae). *Mosq. Syst.* (1990) 22:149-159.
- Horsfall, W.R. 1955. Mosquitoes. Their bionomics and relation to disease. Ronald Press, New York.
- Knight, K.L. and A. Stone. 1977. A catalog of the mosquitoes of the world (Diptera: Culicidae). 2nd edition. Thomas Say Found. 6:xi + 1-611.
- Lane, J. 1953. Neotropical Culicidae. Vols. 1 and 2. University of Sao Paulo, Sao Paulo, Brazil.
- Lane, J. and N.L. Cerqueira. 1942. Os sabetíneos da America (Diptera, Culicidae). *Arq. Zool. Estado Sao Paulo* 3:473-849.
- Stone, A., K.L. Knight and H. Starcke. 1959. A synoptic catalog of the mosquitoes of the world (Diptera, Culicidae). Thomas Say Found. 6:1-358.
- Sutil O., E. and J. Pulido F. 1978. *Sabethes (Sabethes) carrilloi* sp. n. de Venezuela. *Bol. Dir. Malariol. Saneamiento Ambiental* 18:199-204.
- Ward, R.A. 1984. Second supplement to "A catalog of the mosquitoes of the world" (Diptera: Culicidae). *Mosq. Syst.* 16:227-270.